

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
APPLICATION FOR LETTERS PATENT

**Portable Smart Card Secured Memory System For
Porting User Profiles and Documents**

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1 **TECHNICAL FIELD**

2 This invention relates to systems and methods for transporting user profiles
3 and data files from one computer to another. More particularly, this invention
4 relates to a portable profile carrier that enables a user to securely store and
5 transport a user profile and personal data files, while allowing the user to access
6 the profile and data files during log on processes at a standalone or networked
7 computer so that the computer retains the same ‘look and feel’ of the user’s
8 desktop and setup.

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10 **BACKGROUND**

11 Profiles are used by operating systems to configure operating
12 characteristics of a computer (e.g., user interface schema, favorites lists, etc.)
13 according to user-supplied preferences and provide storage for the user’s personal
14 data files (e.g., files on the desktop or in the user’s “My Documents” folder).
15 Windows NT operating systems from Microsoft Corporation supports two types of
16 profiles: local profiles and roaming profiles. A local profile is stored and loaded
17 from a fixed location on the local computer. The profile remains at the computer,
18 and is not portable to another computer. Thus, if the user logs onto another
19 computer, a new profile is created for that user from a default profile. As a result,
20 the user ends up with different profiles on each machine that he/she logs onto and
21 hence, each machine looks and feels differently.

22 A roaming profile travels with the user in a networked environment and is
23 made available to the user regardless of which machine the user logs onto. Fig. 1
24 shows a client-server architecture 20 that implements conventional roaming
25 profiles. The architecture 20 includes a server 22 connected to serve a client 24

over a network 26. The server 22 has an operating system 28 and a profile store 30 that holds various user profiles. The profiles are associated with the users via a passcode. The client 24 runs an operating system 32.

When the user logs onto the client 24, the user is initially prompted for a user name, domain name, and password. The domain name is used to identify the server 22 and the user name is used to locate a corresponding user profile from the profile store 30. If a profile exists (i.e. the user name is known to the server), the password is used in a challenge response exchange with the server to verify the identity of the user. If the user provided the correct password for the given user name, the user's profile is downloaded from the server 22 to the client 24 and used to configure the client according to the user's preferences.

If additional security is warranted, the architecture may further include smart card tokens. The user is assigned a personal smart card and inserts the smart card into a card reader at the client. In this case, the user name, domain name, and password are stored on the smart card. Instead of the user entering this information, the user enters a passcode that unlocks the card and makes the information available to the client, which then performs the logon process as described above.

One drawback with the roaming architecture is that users have only limited control over their own profiles. A user cannot, for instance, establish a roaming profile without the assistance of a network administrator. The administrator must assign a roaming profile pathname in the user's account on the domain server. The user then has the option to indicate on each machine whether to use a roaming profile or a local profile.

1 Another drawback with roaming profiles is that the architecture restricts
2 roaming to clients connected to the network 26 with access to the domain server
3 and the profile server 22. The architecture does not allow a user to access his/her
4 profile on a home computer or other standalone computer that is not network
5 attached.

6 Accordingly, there is a need for a portable device that securely transports a
7 user's profile and related documents (My Documents) to various machines,
8 regardless of whether the machines are connected or standalone. The inventors
9 have developed such a device.

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11 **SUMMARY**

12 This invention concerns a portable profile carrier that stores and securely
13 transports a user's profile and personal user data files from one computer to the
14 next.

15 The profile carrier is a two-component system comprising a smart card (or
16 other integrated circuit (IC) card with processing capabilities) and a memory
17 device. The user profile and personal data files are stored in the memory device.
18 The smart card protects access to the memory device. The composite profile
19 carrier alternately enables access to the user profile on the memory device when
20 the card is present and the user is authenticated, while disabling access when the
21 card is absent or the user is not authenticated.

22 In one implementation, the profile carrier is assigned a pair of public and
23 private keys, with the public key being stored on the memory device and the
24 private key being kept on the smart card. The smart card also stores a passcode
25 that is unique to the user. To access the contents in the memory device, the user is

1 prompted to enter a passcode and the smart card authenticates the user by
2 comparing the user-supplied passcode to the stored passcode. Assuming that the
3 user is legitimate, the smart card then authenticates the memory device as
4 belonging to the user by determining whether the public key is complementary
5 with the private key. If it is, access to the user profile and personal data files on
6 the memory device is permitted.

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8 **BRIEF DESCRIPTION OF THE DRAWINGS**

9 Fig. 1 is a block diagram of a prior art client-server system that supports
10 roaming profiles from one network client to another.

11 Fig. 2 is a block diagram of a system having a portable profile carrier that
12 securely transports user profiles and data files from computer to computer. The
13 portable profile carrier, in conjunction with the computer operating system,
14 enables authenticated access to the profiles and data files at a computer, regardless
15 of whether the computer is a standalone or networked.

16 Fig. 3 is a block diagram of the system components, including the computer
17 operating system, smart card, and memory device.

18 Fig. 4 is a flow diagram showing steps in a two-phase authentication
19 process for accessing user profile and data files carried on the profile carrier.

20 The same numbers are used throughout the figures to reference like
21 components and features.

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1 **DETAILED DESCRIPTION**

2 This invention concerns a portable profile carrier for transporting a user's
3 profile and personal data files from one computer to the next in order to configure
4 each computer according to user preferences. The profile carrier is equipped with
5 sufficient memory to hold data files as well as the user profile. In one
6 implementation, the profile and data files are secured, in part, using cryptographic
7 techniques. Accordingly, the following discussion assumes that the reader is
8 familiar with cryptography. For a basic introduction of cryptography, the reader is
9 directed to a text written by Bruce Schneier and entitled "Applied Cryptography:
10 Protocols, Algorithms, and Source Code in C," published by John Wiley & Sons
11 with copyright 1994 (second edition 1996).

12 .
13 **System**

14 Fig. 2 shows a computer system 50 having a computer 52 and a portable
15 profile carrier 54. The computer 52 has an operating system 56, a memory drive
16 58, and a smart card reader 60. The computer may be configured as a general-
17 purpose computer (e.g., desktop computer, laptop computer, personal digital
18 assistant, etc.), an ATM (automated teller machine), a kiosk, an automated entry
19 system, a set top box, and the like. The machine 52 may be a standalone unit or
20 networked to other computers (not shown).

21 The profile carrier 54 stores a user's profile in a secured medium that can
22 be conveniently transported. The profile consists of user information that can be
23 used to configure computer 52 according to selected preferences and schema of
24 the user. The profile contains essentially all of the information that is useful or
25 personal to the user. For instance, a profile might include a user's name, logon

1 identity, access privileges, user interface preferences (i.e., background, layout,
2 etc.), mouse control preferences (i.e., click speed, etc.), favorites lists, personal
3 address book, the latest electronic mail (sorted according to user criteria) and so
4 forth. One can also envision that application tokens or keys can be stored on the
5 carrier, and that will allow the user to access or use the applications for which
6 he/she has tokens or keys.

7 The profile carrier 54 has two components: a memory device 70 and an
8 integrated circuit (IC) card 72. The IC card has a form factor of a card and is
9 equipped with memory and processing capabilities. The IC card is preferably
10 embodied as a smart card. The memory device 70 can be constructed in many
11 different forms, including floppy diskette, PCMCIA flash memory card (or PC
12 card), Zip memory drive, and other persistent read/write memories.

13 According to this architecture, the two-component profile carrier forms a
14 smart card secured memory system that alternately enables access to the user
15 profile and personal data files on the memory device 70 when the smart card 72 is
16 present, while disabling access when the smart card is absent. The smart card 72
17 is associated with the user (e.g., via a passcode, like an ATM card) to ensure that
18 only the legitimate user can access the smart card. In addition, the memory device
19 70 and smart card 72 are associated with one another (e.g., by sharing a
20 public/private key pair) to securely link the legitimate user to the user profile and
21 data files stored in the memory device.

22 Fig. 3 shows functional components in the computer system 50. Computer
23 52 includes operating system 56, memory drive 58, and smart card reader 60. The
24 operating system 56 has a logon module 80 to facilitate the user logon process.
25 For a Windows NT operating system from Microsoft Corporation, the logon

1 module 80 is the dynamic link library "msgina.dll", a component used by the user
2 logon facility "winlogon.exe". The operating system 56 also has a memory driver
3 82 and a smart card driver 84. The drivers 82 and 84 detect when a memory
4 device 70 and smart card 72 are inserted into the respective memory drive 58 and
5 smart card reader 60.

6 The profile carrier 54 comprises the memory device 70 and smart card 72.
7 The memory device 70 has a read/write controller 90 and persistent memory 92.
8 The memory 92 is partitioned into a public area 94 and a private area 96. A public
9 key 98 is stored in the public area 94 and can be exported from the memory device
10 via the read/write controller 90. The public key 98 is from a public/private key
11 pair assigned to the profile carrier 54, with the corresponding private key being
12 kept on the smart card 72. A user profile 100 and data files 102 are stored in the
13 private area 96 of memory 92. The controller 90 facilitates reading and writing
14 data to the memory device 92 and is capable of protecting the private storage 96
15 from illegitimate access.

16 The detailed internal architecture of smart cards varies greatly between
17 smart cards from different manufacturers. For purposes of this discussion, a very
18 simplified view of a typical smart card will be used. The smart card 72 has an
19 interface 110, a microcontroller or processor 112, and secured storage 114. The
20 microcontroller 112 is preprogrammed to perform certain cryptographic functions
21 and can read from and write to the secured storage 114. The microcontroller 112
22 responds to commands sent via the interface 110 and can send data in response to
23 those commands back to the interface.

24 In this simplified smart card 72, the secured storage 114 contains a
25 passcode 116, a private key 118, and an encryption key 120. Before it will

1 perform any cryptographic functions involving private key 118, the smart card 72
2 is unlocked by a command sent in via the interface 110 that specifies a passcode
3 matching the stored passcode 116. Once unlocked, the smart card can be
4 instructed by other commands to perform cryptographic functions that involve the
5 use of the private key 114, without making the private key available outside of the
6 smart card. The programming of the microcontroller 112 is designed to avoid
7 exposing the passcode 116 and private key 118. Simply, there are no commands
8 that can be issued to the microcontroller 112 via the interface 110 that will reveal
9 the values of the passcode or the private key. In this manner, the smart card
10 prevents a foreign application from ever inadvertently or intentionally mishandling
11 the passcode and key in a way that might cause them to be intercepted and
12 compromised. In constructing smart cards, manufacturers take additional
13 measures to ensure that the secured storage is inaccessible even when the smart
14 card is disassembled and electronically probed.

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16 **Portable Profile Operation**

17 The system described above enables a user to transport a user profile and
18 personal data files on a secured portable device from one computer to the next.
19 The user can upload the user profile from the portable device to the computer and
20 automatically configure the computer to his/her likes and preferences. In this
21 manner, every computer "looks and feels" the same to the user, based on that
22 user's settings and preferences.

23 The profile carrier is configured as a smart card secured flash memory
24 system that alternately enables access to the user profile in flash memory when the
25 smart card is present, while disabling access when the smart card is absent. No

connection to a server for remote downloading of profiles is necessary, as the portable profile carrier contains all of the information needed by the computer for customized configuration.

To access the user profile, the user inserts the memory device 70 into the memory drive 58 and inserts the smart card 72 into the smart card reader 60. Authorization to access the user profile is achieved through a two-phase authentication process. One phase involves user authentication in which the smart card 72 authenticates the user via a passcode challenge. The second phase is a carrier authentication in which the smart card 72 authenticates the memory device 70 as carrying the profile of the user.

Fig. 4 shows steps in the two-phase authentication process that enables access to the user profile and data files. The steps are performed in a combination of hardware and software resident at the computer 52 and smart card 72. The method is also described with additional reference to the system illustrated in Fig. 3.

At step 150, the computer 52 monitors for insertion of the memory device 70 and smart card 72 into their respective drives. In one implementation, the logon module 80 of operating system 56 (i.e., "msgina.dll") continually monitors the memory drive 58 and smart card reader 60. Once the device and card are identified, the logon module 80 proceeds with the logon procedure.

At step 152, the computer operating system 56 prompts the user via a dialog box or other type window to enter a passcode, such as a PIN (Personal Identification Number). After the user enters the passcode, the smart card driver 84 sends the user-supplied passcode to the smart card 72 via the smart card reader 60 (step 154).

1 The smart card microcontroller 112 compares the user-supplied passcode to
2 the passcode 116 stored in secured storage 114 (step 156). If the two fail to match
3 (i.e., the “no” branch from step 158), the microcontroller 112 rejects the entered
4 passcode and returns a failure notice (step 160). Conversely, if the two match, the
5 user has been authenticated and the microcontroller 112 will now accept
6 commands that involve cryptographic operations involving the private key 118.

7 In this manner, the smart card is associated with a particular user through
8 the passcode. Only the legitimate user is assumed to know the passcode and
9 hence, only the legitimate user is able to unlock the smart card.

10 This passcode challenge completes the user authentication phase of the
11 process. The carrier authentication phase is subsequently initiated to determine
12 whether the memory device carries the data of the authenticated user. This phase
13 employs public key cryptography to make the determination. As noted above, the
14 composite profile carrier is assigned a pair of complementary public and private
15 keys, with the public key 98 being stored on memory device 70 and the
16 corresponding private key 118 being stored in the secured storage 114 of smart
17 card 72.

18 At step 164, the memory driver 82 reads the public key 98 from the
19 memory device 70 via the memory drive 58. The memory driver 82 passes the
20 public key 98 to the smart card 72 via the smart card driver 84 and smart card
21 reader 60 (step 166). The smart card microcontroller 112 runs a process using the
22 public key 98 and the private key 118 to determine whether the keys are
23 complementary (step 168). This step determines whether the memory device 70
24 and smart card 72 are associated with one another and form the user’s profile

1 carrier, thereby linking the legitimate user to the user profile and personal data
2 files stored in the memory device of the profile carrier.

3 If the public key is not valid (i.e., the “no” branch from step 170), the
4 microcontroller 112 rejects the entered public key and returns a failure notice
5 indicating that the memory device does not correspond to the smart card or user
6 (step 172). On the other hand, assuming the public key checks out (i.e., the “yes”
7 branch from step 170), the smart card instructs the read/write controller 90 on the
8 memory device 70 to enable access to the user profile and data files in the private
9 area 96 of the memory 92 (step 174). At this point, the computer is permitted to
10 read the user profile and data files from the memory device 70 and normal logon
11 processes are continued using the profile data from the memory (step 176). The
12 computer configures the computer according to the user profile. The memory is
13 also made available as a peripheral storage device for the computer. The operating
14 system presents an icon or name in a file system user interface to inform the user
15 that the memory is addressable and available.

16 After the user completes a session at this computer, the user can save any
17 files or other data to the flash memory. The user is then free to remove the profile
18 carrier from the computer and carry it to another computer. The user can then
19 repeat the same operation described above to import his/her profile to the next
20 computer. As a result of this architecture, one source of security is that both user
21 authentication and possession of both components of the profile carrier during
22 logon are employed to gain access to the user profile and data files.

23 The scheme described is secure if the computer 52 can be trusted to
24 correctly pass the public key 98 to the smart card 72, and correctly pass the
25 accepts/reject response from the smart card 72 to the read/write controller 90.

1 To further protect the private contents in the memory device 70, the
2 contents can be encrypted (e.g. DES encryption) using a key that can only be
3 obtained from the smart card 72 after the smart card has been successfully
4 unlocked by the user providing the correct passcode. In this case, the computer 52
5 sends a command to the smart card 72 via the interface 110 to obtain the
6 encryption key 120, which it passes to the read/write controller 90. The read/write
7 controller uses this key to decrypt the user profile 100 and user documents 102 as
8 the computer makes requests to read this data. Similarly when this data is written
9 back to the memory device 70 the read/write controller 90 uses the key to encrypt
10 the data before writing it to the private memory area 96.

11

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Conclusion

13 Although the invention has been described in language specific to structural
14 features and/or methodological steps, it is to be understood that the invention
15 defined in the appended claims is not necessarily limited to the specific features or
16 steps described. Rather, the specific features and steps are disclosed as preferred
17 forms of implementing the claimed invention.

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